

Laboratory Safety Standard

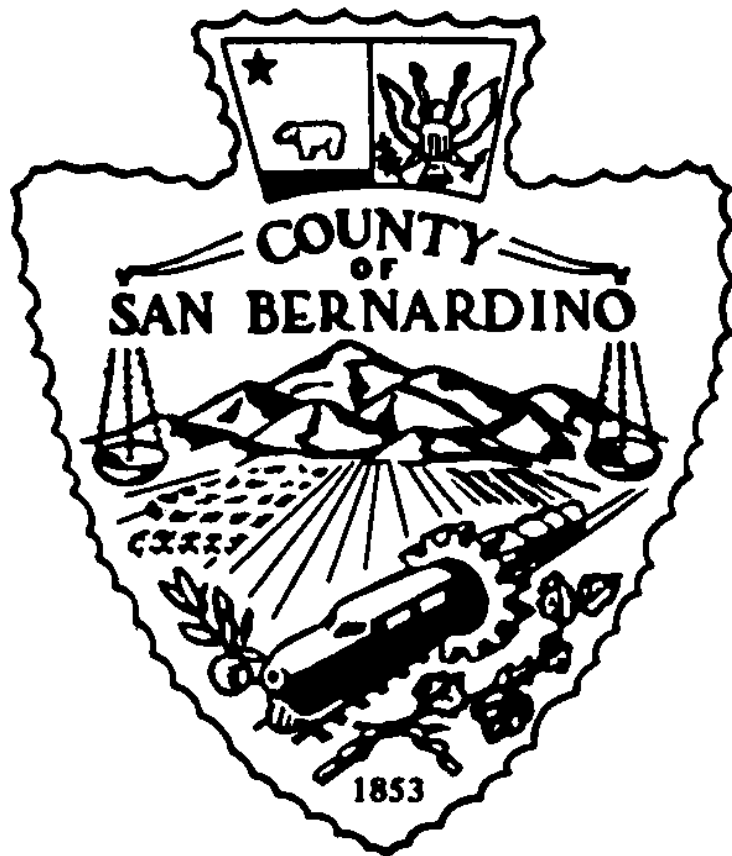


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LABORATORY SAFETY STANDARDS

SCOPE

These standards shall apply to all departments engaged in laboratory use of hazardous chemicals as defined herein.

Where this section applies, it shall supersede, for laboratories, the requirements of Title 8 of the California Code of Regulations Section 4190 and Article 110, Regulated Carcinogens, of the General Industry Safety Orders, except as follows:

1. The requirement to limit employee exposure to the specific Exposure Limit for the Carcinogen involved;
2. Prohibition or prevention of eye and skin contact where specified by any health regulation shall be observed;
3. Where the Action Level (or in the absence of an Action Level, the Exposure Limit) is exceeded for a regulated substance when such substance is covered by exposure monitoring and medical surveillance requirements;
4. The "report of use" requirements for Regulated Carcinogen regulations;
5. Regulations governing the use of formaldehyde shall apply to anatomy, histology and pathology laboratories.

These standards do not apply to:

1. Uses of hazardous chemicals which do not meet the definition of laboratory use. In such cases, the department shall comply with relevant regulations in Title 8, California Code of Regulations, even if such use occurs in a laboratory.
2. Laboratory uses of hazardous chemicals which provide no potential for employee exposure. Examples of such conditions include:
 - a. Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be tested and the results are interpreted by comparing the color reaction to a

color chart supplied by the manufacturer of the test strip; and

- b. Commercially prepared kits such as those used in performing pregnancy tests in which all the reagents needed to conduct the test are contained in the kit.

DEFINITIONS

Action Level. A concentration designated for a specific substance. Action Levels are calculated as an eight (8)-hour time weighted average, and when reached, initiate activities such as exposure monitoring and medical surveillance.

Carcinogen. Any substance which meets one of the following criteria:

1. It is regulated by Cal/OSHA as a carcinogen; or,
2. It is listed under the category, "known to be carcinogens", in the Annual Report on Carcinogens published by the National Toxicology Program (NTP); or,
3. It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC); or,
4. It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:
 - a. After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m³;
 - b. After repeated skin application of less than 300 mg/kg of body weight per week; or,
 - c. After oral dosages of less than 50 mg/kg of body weight per day.

Chemical Hygiene Coordinator. An employee designated by the department, who is qualified by training or experience to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.

Chemical Hygiene Plan. A written program developed and implemented by the department which sets forth procedures, equipment, personal protective equipment and work practices that (1) are capable of protecting employees from health hazards presented by hazardous chemicals used in a particular workplace and (2) meets the requirements as defined beginning on page 92 herein under the heading "Chemical Hygiene Plan."

Combustible Liquid. Any liquid having a flashpoint at or above 100°F (37°C), or components with flashpoints of 200°F (93.3°C), or higher, the total volume of which make up 99% or more of the total volume of the mixture.

Compressed Gas. (1) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or (2) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C); or (3) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C).

Designated Area. An area which may be used for work with "carcinogens," reproductive toxins or substances which have a high degree of acute toxicity. A designated area may be the entire laboratory, an area of a laboratory or a device such as a laboratory hood.

Emergency. Any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Explosive. A chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Flammable. A chemical that falls into one of the following categories:

1. "Aerosol, flammable" means an aerosol that, yields a flame projection exceeding

19 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

2. "Gas, flammable" means:
 - a. A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or
 - b. A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air greater than 12% by volume, regardless of the Lower Explosive Limit.
3. "Liquid, flammable" means any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up 99% or more of the total volume of the mixture.
4. "Solid, flammable" means a solid, other than a blasting agent or explosive, that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

Flashpoint. The minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.

Hazardous Chemical. A chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

Laboratory. A facility where the "laboratory use of hazardous chemicals" occurs. It is a

workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory Scale. Work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person, "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type Hood. A device located in a laboratory, enclosed on five sides with a movable sash or fixed partial enclosure on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory Use of Hazardous Chemicals.

Handling or use of such chemicals in which all of the following conditions are met:

1. Chemical manipulations are carried out on "laboratory scale";
2. Multiple chemical procedures or chemicals are used;
3. The procedures involved are not part of a production process, nor in any way simulate a production process; and
4. "Protective laboratory practices and equipment" are available and in common use industry-wide to minimize the potential for employee exposure to hazardous chemicals.

Medical Consultation. A consultation which takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

Physical Hazard. A chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

Protective Laboratory Practices and Equipment. Those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

Reproductive Toxins. Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

Unstable (reactive). A chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

Water-reactive. A chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

EXPOSURE LIMITS

For laboratory uses of regulated substances, the department shall ensure that employee exposure does not exceed exposure limits specified in Title 8, California Code of Regulations, Group 16, Section 5139 of the General Industry Safety Orders.

EMPLOYEE EXPOSURE DETERMINATION

Initial Monitoring. Departments shall measure employee exposure to any substance regulated by a standard **if there is reason to believe that exposure to that substance exceeds Action Levels (or in the absence of an Action Level, the Exposure Limit).** The person supervising, directing or evaluating the monitoring shall be competent in industrial hygiene practice.

Periodic Monitoring. If initial monitoring discloses employee exposure over the Action Level (or in the absence of an Action Level, Exposure Limits), a department shall immediately comply with the exposure monitoring provisions of relevant regulations.

Notification of Monitoring Results. Departments shall, within 15 working days after the receipt of any monitoring results, notify employees of results in writing either individually or by posting results in an appropriate location that is accessible to all employees.

CHEMICAL HYGIENE PLAN

Where hazardous chemicals are used in the work-place, departments shall develop and carry out provisions of a written Chemical Hygiene Plan which is:

1. Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory; and
2. Capable of keeping exposures below limits established by regulation.

The Chemical Hygiene Plan shall be readily available to employees, and employee representatives.

The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that departments will take to ensure laboratory employee protection:

1. Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;
2. Criteria that departments will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, and the use of personal protective equipment and hygiene practices. Particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;
3. A requirement that fume hoods comply with regulations, that all protective equipment shall function properly and that specific measures shall be taken to ensure proper and adequate performance of such equipment;
4. Provisions for employee information and training;
5. The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from

the management or a designee before implementation;

6. Provisions for medical consultation and medical examinations;
7. Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Coordinator; and
8. Provisions for additional employee protection for work with particularly hazardous substances. These include "carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:
 - a. Establishment of a designated area;
 - b. Use of containment devices such as fume hoods or glove boxes;
 - c. Procedures for safe removal of contaminated waste; and
 - d. Decontamination procedures.

Departments shall review and evaluate the effectiveness of their Chemical Hygiene Plan at least annually and update it as necessary.

EMPLOYEE INFORMATION AND TRAINING

Departments shall provide information and training to ensure that employees are apprised of the hazards of chemicals present in the work area.

Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations.

Information. Employees shall be informed of:

1. The contents of these standards;
2. The location and availability of the Chemical Hygiene Plan;
3. The exposure limits for regulated substances;

4. Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and
5. The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

Training. Employee training shall include:

1. Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
2. The physical and health hazards of chemicals in the work area; and
3. The measures employees can take to protect themselves from hazards, including specific procedures implemented to protect employees from exposure to hazardous chemicals - such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

MEDICAL CONSULTATION AND MEDICAL EXAMINATIONS

Departments shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which an examining physician determines to be necessary, under the following circumstances:

1. Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination;
2. Where exposure monitoring reveals an exposure level above the Action Level (or in the absence of an Action Level, Exposure Limit) for a regulated

substance, medical surveillance shall be established for the affected employee;

3. Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, affected employees shall be provided an opportunity for a **medical consultation**. Such consultation shall be for the purpose of determining the need for a medical examination.

All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

Information provided to the physician. Departments shall provide the following information to the physician:

1. The identity of the hazardous chemical(s) to which the employee may have been exposed;
2. A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
3. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

Physician's written opinion. For examination or consultation required under this standard, the department shall obtain a written opinion from the examining physician which is to include the following:

1. Recommendations for further medical follow-up;
2. The results of the medical examination and any associated tests, if requested by the employee;
3. Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and

4. A statement that the employee has been informed by the physician of the results of the consultation that may require further examination or treatment.

HAZARD IDENTIFICATION

With respect to labels and Material Safety Data Sheets:

1. Departments shall ensure that labels on containers of hazardous chemicals are not removed or defaced.
2. Departments shall maintain in the workplace Material Safety Data Sheets for hazardous chemicals, and ensure they are readily accessible to employees.

The following provisions shall apply to chemical substances developed in the laboratory:

1. If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the department shall determine if it is a hazardous chemical. If the chemical is determined to be hazardous, the department shall provide appropriate training.
2. If the chemical produced is a byproduct whose composition is not known, departments shall assume that the substance is hazardous and therefore covered by the provisions herein.
3. If the chemical substance is produced for commercial purposes by another user outside of the laboratory, the department shall comply with Hazard Communication regulations including requirement for preparation of Material Safety Data Sheets and labeling.

USE OF RESPIRATORS

Where the use of respirator is necessary to maintain exposure below Permissible Exposure Limits, departments shall provide the proper respiratory equipment. Respirators shall be selected and used in accordance with requirements of the County of San Bernardino Respirator Protection Program.

RECORDKEEPING

Departments shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by these standards.

APPENDIX A

NATIONAL RESEARCH COUNCIL RECOMMENDATIONS CONCERNING CHEMICAL HYGIENE IN LABORATORIES

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Safety Recommendations

Safety Data Sheets

FORWARD

As guidance for each department's development of an appropriate laboratory Chemical Hygiene Plan, the following non-mandatory recommendations are provided. They were extracted from "Prudent Practices for Handling Hazardous Chemicals in Laboratories" (referred to below as "Prudent Practices"), which was published in 1981 by the National Research Council and is available from the National Academy Press, 2101 Constitution Ave., NW, Washington DC 90418.

"Prudent Practices" is cited because of its wide distribution and acceptance and because of

the preparation by members of the laboratory community through the sponsorship of the National Research Council. None of the recommendations given herein will modify any requirements of the County of San Bernardino Laboratory Safety Standards.

This Appendix merely presents pertinent recommendations from "Prudent Practices", organized into a form convenient for quick reference during operation of a laboratory facility and during development and application of a Chemical Hygiene Plan. Users of this appendix may consult "Prudent Practices" for a more extended presentation and justification for each recommendation.

"Prudent Practices" deals with both safety and chemical hazards while the County Safety Standard is concerned primarily with chemical hazards. Therefore, only those recommendations directed primarily toward control of toxic exposures are cited in this appendix, with the term "chemical hygiene" being substituted for the word "safety".

The recommendations from "Prudent Practices" have been paraphrased, combined, or otherwise reorganized, and headings have been added. However, their sense has not been changed.

CORRESPONDING SECTIONS OF THE REGULATION AND THIS APPENDIX

The following table is given for the convenience of those who are developing a Chemical Hygiene Plan which will satisfy the requirements of the County of San Bernardino Laboratory Safety Standards and related sections of this appendix.

TOPIC IN LABORATORY STANDARD	RELEVANT APPENDIX SECTION
Standard operating procedures for handling toxic chemicals.	C, D, E
Criteria to be used for implementation of measures to reduce exposures.	D
Fume hood performance.	C
Employee information and training (including emergency procedures).	D
Requirements for prior approval of laboratory activities.	E
Medical consultation and medical examinations.	D, E
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In this appendix, those recommendations directed primarily at administrators and supervisors are given in sections A - D. Those recommendations of primary concern to employees who are actually handling laboratory chemicals are given in section E.

A. GENERAL PRINCIPLES FOR WORK WITH LABORATORY CHEMICALS

In addition to the more detailed recommendations listed below in sections B-E, "Prudent Practices" expresses certain general principles, including the following:

1. It is prudent to minimize all chemical exposures. Because few laboratory chemicals are without hazards, general precautions for handling all laboratory chemicals should be adopted, rather than specific guidelines for particular chemicals. Skin contact with chemicals should be avoided as a cardinal rule.
2. Avoid underestimation of risk. Even for substances of no known significant hazard, exposure should be minimized; for work with substances which present special hazards, special precautions should be taken. One should assume that any mixture will be more toxic than its most toxic component and that all substances of unknown toxicity are toxic.
3. Provide adequate ventilation. The best way to prevent exposure to airborne substances is to prevent their escape into the working atmosphere by use of hoods and other ventilation devices.
4. Institute a chemical hygiene program. A mandatory chemical hygiene program designed to minimize exposures is needed; it should be a regular, continuing effort, not merely a standby or short-term activity. Its recommendations should be followed in academic teaching laboratories as well as by full-time laboratory workers.
5. Observe the exposure limits and TLVs. The Exposure Limits of Cal/OSHA and the Threshold Limit Values of the American Conference of Governmental Industrial Hygienists should not be exceeded.

B. CHEMICAL HYGIENE RESPONSIBILITIES

Responsibility for chemical hygiene rests at all levels including the:

1. Chief executive officer, who has ultimate responsibility for chemical hygiene within

the institution and must, with other administrators, provide continuing support for institutional chemical hygiene.

2. Supervisor of the department or other administrative unit, who is responsible for chemical hygiene in that unit.
3. Chemical hygiene officer(s), whose appointment is essential and who must:
 - a. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;
 - b. Monitor procurement, use, and disposal of chemicals used in the lab;
 - c. See that appropriate audits are maintained;
 - d. Help project directors develop precautions and adequate facilities;
 - e. Know the current legal requirements concerning regulated substances; and
 - f. Seek ways to improve the chemical hygiene program.
4. Laboratory supervisor, who has overall responsibility for chemical hygiene in the laboratory including responsibility to:
 - a. Ensure that workers know and follow the chemical hygiene rules, that protective equipment is available and in working order, and that appropriate training has been provided;
 - b. Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;
 - c. Know the current legal requirement concerning regulated substances;
 - d. Determine the required levels of protective apparel and equipment; and
 - e. Ensure that facilities and training for use of any material being ordered are adequate.

5. Project director or director of other specific operation, who has primary responsibility for chemical hygiene procedures for that operation.
6. Laboratory worker, who is responsible for:
 - a. Planning and conducting each operation in accordance with the institutional chemical hygiene procedures; and
 - b. Developing good personal chemical hygiene habits.

B. THE LABORATORY FACILITY

Design. The laboratory facility should have:

1. An appropriate general ventilation system (see below) with air intakes and exhausts located so as to avoid intake of contaminated air;
2. Adequate, well-ventilated stockrooms/store-rooms;
3. Laboratory hoods and sinks;
4. Other safety equipment including eyewash fountains and drench showers; and
5. Arrangements for waste disposal.

Maintenance. Chemical-hygiene-related equipment (hoods, incinerator, etc.) should undergo continual appraisal and be modified if inadequate.

Usage. The work conducted and its scale must be appropriate to the physical facilities available and especially, to the quality of ventilation.

Ventilation.

1. General laboratory ventilation. This system should: Provide a source of air for breathing and for input to local ventilation devices; it should not be relied on for protection from toxic substances released into the laboratory; ensure that laboratory air is continually replaced, preventing increase of air concentrations of toxic substances during the working day; direct air flow into the laboratory from non-

laboratory areas and out to the exterior of the building.

2. Hoods. A laboratory hood with 2.5 linear feet of hood space per person should be provided for every 2 workers if they spend most of their time working with chemicals; each hood should have a continuous monitoring device to allow convenient confirmation of adequate hood performance before use. If this is not possible, work with substances of unknown toxicity should be avoided or other types of local ventilation devices should be provided.
3. Other local ventilation devices. Ventilated storage cabinets, canopy hoods, snorkels, etc. should be provided as needed. Each canopy hood and snorkel should have separate exhaust duct.
4. Special ventilation areas. Exhaust air from glove boxes and isolation rooms should be passed through scrubbers or other treatment before release into the regular exhaust system. Cold rooms and warm rooms should have provisions for rapid escape and for escape in the event of electrical failure.
5. Modifications. Any alteration of the ventilation system should be made only if thorough testing indicates that worker protection from airborne toxic substances will continue to be adequate.
6. Performance. Rate: 4-12 room air changes/ hour is normally adequate general ventilation if local exhaust systems such as hoods are used as the primary method of control.
7. Quality. General air flow should not be turbulent and should be relatively uniform throughout the laboratory, with no high velocity or static areas; airflow into and within the hood should not be excessively turbulent; hood face velocity should be adequate (typically 60-100 cfm).
8. Evaluation. Quality and quantity of ventilation should be evaluated on installation, regularly monitored (at least every 3 months), and reevaluated whenever a change in local ventilation devices is made.

B. COMPONENTS OF THE CHEMICAL HYGIENE PLAN

Chemical Procurement, Distribution, and Storage

Procurement. Before a substance is received, information on proper handling, storage, and disposal should be known to those who will be involved. No container should be accepted without an adequate identifying label. Preferably, all substances should be received in a central location.

Stockrooms/storerooms. Toxic substances should be segregated in a well-identified area with local exhaust ventilation. Chemicals which are highly toxic or other chemicals whose containers have been opened should be in unbreakable secondary containers. Stored chemicals should be examined periodically (at least annually) for replacement, deterioration, and container integrity.

Stockrooms/storerooms should not be used as preparation or repackaging areas, should be open during normal working hours, and should be controlled by one person.

Distribution. When chemicals are hand carried, the container should be placed in an outside container or bucket. Freight-only elevators should be used if possible.

Laboratory storage. Amounts permitted should be as small as practical. Storage on bench tops and in hoods is inadvisable. Exposure to heat or direct sunlight should be avoided. Periodic inventories should be conducted, with unneeded items being discarded or returned to the storeroom/stockroom.

Environmental Monitoring

Regular instrumental monitoring of airborne concentrations is not usually justified or practical in laboratories but may be appropriate when testing or redesigning hoods or other ventilation devices or when a highly toxic substance is stored or used regularly (e.g., 3 times/week).

Housekeeping, Maintenance, and Inspections

Cleaning. Floors should be cleaned regularly.

Inspections. Formal housekeeping and chemical hygiene inspections should be held

at least quarterly for units which have frequent personnel changes and semiannually for others; informal inspections should be continual.

Maintenance. Eye wash fountains should be inspected at intervals of not less than 3 months. Respirators for routine use should be inspected periodically by the laboratory supervisor. Safety showers should be tested routinely. Other safety equipment should be inspected regularly, (e.g., every 3-6 months). Procedures to prevent restarting of out-of-service equipment should be implemented as required the County of San Bernardino Lockout/Tag-out/Blockout Program.

Passageways. Stairways and hallways should not be used as storage areas.

Medical Program

Compliance With Regulations. Regular medical surveillance should be established to the extent required by regulations.

Routine Surveillance. Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable.

First Aid. Personnel trained in first aid should be available during working hours and an emergency room with medical personnel should be nearby.

Protective Apparel and Equipment

These should include for each laboratory:

1. Protective apparel compatible with the required degree of protection for substances being handled;
2. An easily accessible drench-type safety shower;
3. An eyewash fountain;
4. A fire extinguisher;
5. Respiratory protection, fire alarm and telephone for emergency use should be available nearby; and

6. Other items designated by the laboratory supervisor.

Records

Accident records should be written and retained.

Chemical Hygiene Plan records should document that the facilities and precautions were compatible with current knowledge and regulations.

Inventory and usage records for high-risk substances should be kept as specified below.

Medical records should be retained by the institution in accordance with the requirements of state and federal regulations.

Signs and Labels

Prominent signs and labels of the following types should be posted:

1. Emergency telephone numbers of emergency personnel/facilities, supervisors, and laboratory workers;
2. Identity labels, showing contents of containers (including waste receptacles) and associated hazards;
3. Location signs for safety showers, eyewash stations, other safety and first aid equipment, exits and areas where food and beverage consumption and storage are permitted; and
4. Warnings at areas or equipment where special or unusual hazards exist.

Spills and Accidents

A written emergency plan should be established and communicated to all personnel; it should include procedures for ventilation failure, evacuation, medical care, reporting, and drills.

There should be an alarm system to alert people in all parts of the facility including isolation areas such as cold rooms.

A spill control policy should be developed and should include consideration of prevention, containment, cleanup, and reporting.

All accidents or near accidents should be carefully analyzed with the results distributed to all who might benefit.

Information and Training Program

Aim. To ensure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs.

Emergency and Personal Protection Training. Every laboratory worker should know the location and proper use of available protective apparel and equipment. Some of the full-time personnel of the laboratory should be trained in the proper use of emergency equipment and procedures. Such training as well as first aid instruction should be available to and encouraged for everyone who might need it.

Receiving and stockroom/storeroom personnel should know about hazards, handling equipment, protective apparel, and relevant regulations.

Frequency of Training. The training and education program should be a regular, continuing activity - not simply an annual presentation.

Literature/Consultation. Literature and consulting advice concerning chemical hygiene should be readily available to laboratory personnel, who should be encouraged to use these information resources.

Waste Disposal Program

Aim. To ensure that minimal harm to people, other organisms, and the environment will result from the disposal of waste laboratory chemicals.

Content. The waste disposal program should specify how waste is to be collected, segregated, stored, and transported and include consideration of what materials can be incinerated. Transport from the institution must be in accordance with DOT regulations.

Discarding Chemical Stocks. Unlabeled containers of chemicals and solutions should undergo prompt disposal; if partially used, they should not be opened. Before a worker's employment in the laboratory ends, chemicals

for which that person was responsible should be discarded or returned to storage.

Frequency of Disposal. Waste should be removed from laboratories to a central waste storage area at least once per week and from the central waste storage area at regular intervals.

Method of Disposal. Incineration in an environmentally acceptable manner is the most practical disposal method for combustible laboratory waste.

Indiscriminate disposal by pouring waste chemicals down the drain or adding them to mixed refuse for landfill burial is unacceptable.

Hoods should not be used as a means of disposal for volatile chemicals.

Disposal by recycling or chemical de-contamination should be used when possible.

C. BASIC RULES AND PROCEDURES FOR WORKING WITH CHEMICALS

The Chemical Hygiene Plan should require that laboratory workers know and follow its rules and procedures. In addition to the procedures of the sub programs mentioned above, these should include the rules listed below.

General Rules

The following should be used for essentially all laboratory work with chemicals:

1. **Accidents and spills - Eye Contact:**
Promptly flush eyes with water for a prolonged period (15 minutes) and seek medical attention.

Ingestion - Encourage the victim to drink large amounts of water.

Skin Contact - Promptly flush the affected area with water and remove any contaminated clothing. If symptoms persist after washing, seek medical attention.

Clean-up - Promptly clean up spills, using appropriate protective apparel and equipment and proper disposal.

2. Avoidance of "routine" exposure. Develop and encourage safe habits; avoid unnecessary exposure to chemicals by any route;

Do not smell or taste chemicals. Vent apparatus which may discharge toxic chemicals (vacuum pumps, distillation columns, etc.) into local exhaust devices.

Inspect gloves and test glove boxes before use.

Do not allow release of toxic substances in cold rooms and warm rooms, since these have contained recirculated atmospheres.

3. Choice of chemicals. Use only those chemicals for which the quality of the available ventilation system is appropriate.
4. Eating, smoking, etc.. Avoid eating, drinking, smoking, gum chewing, or application of cosmetics in areas where laboratory chemicals are present; wash hands before conducting these activities. Avoid storage, handling, or consumption of food or beverages in storage areas, refrigerators, glassware or utensils which are also used for laboratory operations.
5. Equipment and glassware. Handle and store laboratory glassware with care to avoid damage; do not use damaged glassware. Use extra care with Dewar flasks and other evacuated glass apparatus; shield or wrap them to contain chemicals and fragments should implosion occur. Use equipment only for its designed purpose.
6. Exiting. Wash areas of exposed skin well before leaving the laboratory.
7. Horseyplay. Avoid practical jokes or other behavior which might confuse, startle or distract another worker.
8. Mouth suction. Do not use mouth suction for pipeting or starting a siphon.
9. Personal apparel. Confine long hair and loose clothing. Wear shoes at all times in the laboratory but do not wear sandals, perforated shoes, or sneakers.

10. Personal housekeeping. Keep the work area clean and uncluttered, with chemicals and equipment being properly labeled and stored; clean up the work area on completion of an operation or at the end of each day.

11. Personal protection. Assure that appropriate eye

protection is worn by all persons, including visitors, where chemicals are stored or handled.

Wear appropriate gloves when the potential for contact with toxic materials exists; inspect the gloves before each use, wash them before removal, and replace them periodically.

Use appropriate respiratory equipment when air contaminant concentrations are not sufficiently restricted by engineering controls, inspecting the respirator before use.

Use any other protective and emergency apparel and equipment as appropriate.

Avoid use of contact lenses in the laboratory unless necessary; if they are used, inform supervisor so special precautions can be taken.

Remove laboratory coats immediately on significant contamination.

12. Planning. Seek information and advice about hazards, plan appropriate protective procedures, and plan positioning of equipment before beginning any new operation.

13. Unattended operations. Leave lights on, place an appropriate sign on the door, and provide for containment of toxic substances in the event of failure of a utility service (such as cooling water) to an unattended operation.

14. Use of hood. Use the hood for operations which might result in release of toxic chemical vapors or dust.

As a rule of thumb, use a hood or other local ventilation device when working with

any appreciably volatile substance with a TLV of less than 50 ppm.

Confirm adequate hood performance before use; keep hood closed at all times except when adjustments within the hood are being made; keep materials stored in hoods to a minimum and do not allow them to block vents or air flow

Leave the hood "on" when it is not in active use if toxic substances are stored in it or if it is uncertain whether adequate general laboratory ventilation will be maintained when it is "off".

15. Vigilance. Be alert to unsafe conditions and see that they are corrected when detected.

16. Waste disposal. Assure that the plan for each laboratory operation includes plans and training for waste disposal.

Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the Chemical Hygiene Plan.

Do not discharge to the sewer concentrated acids or bases; highly toxic, malodorous, or lachrymatory substances; or any substances which might interfere with the biological activity of waste water treatment plants, create fire or explosion hazards, cause structural damage or obstruct flow.

17. Working alone. Avoid working alone in a building; do not work alone in a laboratory if the procedures being conducted are hazardous.

Working with Allergens and Embryotoxins

Allergens (examples: diazomethane, isocyanates, bi-chromates). Wear suitable gloves to prevent hand contact with allergens or substances of unknown allergenic activity.

Embryotoxins (examples: organomercurials, lead compounds, formamide). If you are a woman of childbearing age, handle these substances only in a hood whose satisfactory performance has been confirmed, using appropriate protective apparel (especially gloves) to prevent skin contact.

Review each use of these materials with the research supervisor and review continuing uses annually or whenever a procedural change is made.

Store these substances, properly labeled, in an adequately ventilated area in an unbreakable secondary container.

Notify supervisors of all incidents of exposure or spills; consult a qualified physician when appropriate.

Work with Chemicals of Moderate Chronic or High Acute Toxicity

Examples: diisopropyl fluorophosphate, hydrofluoric acid, hydrogen cyanide.

Supplemental rules to be followed in addition to those mentioned above.

Aim. to minimize exposure to these toxic substances by any route using all reasonable precautions.

Applicability. These precautions are appropriate for substances by any route using all reasonable precautions.

Applicability. These precautions are appropriate for substances with moderate chronic or high acute toxicity used in significant quantities.

Location. Use and store these substances only in areas of restricted access with special warning signs.

Always use a hood (previously evaluated to confirm adequate performance with a face velocity of at least 60 linear feet per minute) or other containment device for procedures which may result in the generation of aerosols or vapors containing the substance; trap released vapors to prevent their discharge with the hood exhaust.

Personal protection. Always avoid skin contact by use of gloves and long sleeves (and other protective apparel as appropriate). Always wash hands and arms immediately after working with these materials.

Records. Maintain records of the amounts of these materials on hand, amounts used, and the names of the workers involved.

Prevention of spills and accidents. Be prepared for accidents and spills.

Ensure that at least 2 people are present at all times if compound in use is highly toxic or of unknown toxicity.

Store breakable containers of these substances in chemically resistant trays; also work and mount apparatus above such trays or cover work and storage surfaces with removable, absorbent, plastic backed paper.

If a major spill occurs outside the hood, evacuate the area; assure that cleanup personnel wear suitable protective apparel and equipment.

Waste. Thoroughly decontaminate or incinerate contaminated clothing or shoes. If possible, chemically decontaminate by chemical conversion.

Store contaminated waste in closed, suitably labeled, impervious containers (for liquids, in glass or plastic bottles half-filled with vermiculite).

Work with Chemicals of High Chronic Toxicity

Examples: dimethylmercury and nickel carbonyl, benzo-a-pyrene, n-nitrosodiethylamine, other human carcinogens or substances with high carcinogenic potency in animals. Further supplemental rules to be followed, in addition to all these mentioned above, for work with substances of known high chronic toxicity (in quantities above a few milligrams to a few grams, depending on the substance).

Access. Conduct all transfers and work with these substances in a "controlled area": a restricted access hood, glove box, or portion of a lab, designated for use of highly toxic substances, for which all people with access are aware of the substances being used and necessary precautions.

Approvals. Prepare a plan for use and disposal of these materials and obtain the approval of the laboratory supervisor.

Non-contamination/Decontamination. Protect vacuum pumps against contamination by scrubbers or HEPA filters and vent them into the hood. Decontaminate vacuum pumps or other contaminated equipment, including glassware, in the hood before removing them from the controlled area. Decontaminate the

controlled area before normal work is resumed there.

Exiting. On leaving a controlled area, remove any protective apparel (placing it in an appropriate, labeled container) and thoroughly wash hands, forearms, face, and neck.

Housekeeping. Use a wet mop or a vacuum cleaner equipped with a HEPA filter instead of dry sweeping if the toxic substance was a dry powder.

Medical surveillance. If using toxicologically significant quantities of such a substance on a regular basis (e.g., 3 times per week), consult a qualified physician concerning desirability of regular medical surveillance.

Records. Keep accurate records of the amounts of these substances stored and used, the dates of use, and names of users.

Signs and labels. Assure that the controlled area is conspicuously marked with warning and restricted access signs and that all containers of these substances are appropriately labeled with identity and warning labels.

Spills. Assure that contingency plans, equipment, and materials to minimize exposures of people and property in case of accident are available.

Storage. Store containers of these chemicals only in a ventilated, limited access area in appropriately labeled, unbreakable, chemically resistant, secondary containers.

Glove boxes. For a negative pressure glove box, ventilation rate must be at least 2 volume changes/hour and pressure at least 0.5 inches of water. For a positive pressure glove box, thoroughly check for leaks before each use. In either case, trap the exit gases or filter them through a HEPA filter and then release them into the hood.

Waste. Use chemical decontamination whenever possible; ensure that containers of

contaminated waste (including washings from contaminated flasks) are transferred from the controlled area in a secondary container under the supervision of authorized personnel.

Animal Work with Chemicals of High Chronic Toxicity

Access. For large scale studies, special facilities with restricted access area preferable.

Administration of the toxic substance. When possible, administer the substance by injection or gavage instead of in the diet. If administration is in the diet, use a caging system under negative pressure or under laminar air flow directed toward HEPA filters.

Aerosol suppression. Devise procedures which minimize formation and dispersal of contaminated aerosols, including those from food, urine, and feces (e.g., use HEPA filtered vacuum equipment for cleaning, moisten contaminated bedding before removal from the cage, mix diets in closed containers in a hood.

Personal protection. When working in the animal room, wear plastic or rubber gloves, fully buttoned laboratory coat or jumpsuit and, if needed because of incomplete suppression of aerosols, other apparel and equipment (shoe and head coverings, respirator).

Waste disposal. Dispose of contaminated animal tissues and excreta by incineration if the available incinerator can convert the contaminant to non-toxic products; otherwise, package the waste appropriately for burial in an EPA-approved site.

safety/docs/sftymnl/master/labsafety.doc

APPENDIX B - REFERENCES (NON-MANDATORY)

The following references are provided to assist the employer in the development of a Chemical Hygiene Plan. The materials listed below are offered as non-mandatory guidance. References listed here do not imply specific endorsement of a book, opinion, technique, policy or a specific solution for a safety or health problem. Other references not listed here may better meet the needs of a specific laboratory.

Materials for the development of the Chemical Hygiene Plan:

1. American Chemical Society, Safety in Academic Chemistry Laboratories, 4th edition, 1985.
2. Fawcett, H.H. and W.S. Wood, Safety and Accident Prevention in Chemical Operations, 2nd edition, Wiley-Interscience, New York, 1982.
3. Flury, Patricia A., Environmental Health and Safety in the Hospital Laboratory, Charles C. Thomas Publisher, Springfield IL, 1978.
4. Green, Michael E. and Turk, Amos, Safety in Working with Chemicals, Macmillan Publishing Co., NY, 1978.
5. Kaufman, James A., Laboratory Safety Guidelines, Dow Chemical Co., Box 1713, Midland, MI 48640, 1977.
6. National Institutes of Health, NIH Guidelines for the Laboratory use of Chemical Carcinogens, NIH Pub. No. 81-2385, GPO, Washington, DC 20402, 1981.
7. National Research Council, Prudent Practices for Disposal of Chemicals from Laboratories, National Academy Press, Washington, DC, 1983.
8. National Research Council, Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Academy Press, Washington, DC, 1981

9. Renfrew, Malcolm, Ed., Safety in the Chemical Laboratory, Vol. IV, J. Chem. Ed., American Chemical Society, Easlon, PA, 1981.
10. Steere, Norman V., Ed., Safety in the Chemical Laboratory, J. Chem. Ed. American Chemical Society, Easlon, PA, 18042, Vol. I, 1967, Vol. II, 1971, Vol. III, 1974.
11. Steere, Norman v., Handbook of Laboratory Safety, the Chemical Rubber Company Cleveland, OH, 1971.
12. Young, Jay A., Ed., Improving Safety in the Chemical Laboratory, John Wiley & Sons, Inc., New York, 1987.

Hazardous Substances Information:

1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes, P.O. Box 1937, Cincinnati, OH 45201 (1990-1991 edition).
2. Annual Report on Carcinogens, National Toxicology Program U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC, (1985 edition).
3. Best Company, Best Safety Directory, Vols. I and II, Oldwick, N.J., 1981.
4. Bretherick, L., Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.
5. Bretherick, L., Hazards in the Chemical Laboratory, 3rd edition, Royal Society of Chemistry, London, 1986.
6. Code of Federal Regulations, 29 CFR part 1910 subpart Z. U.S. Govt. Printing Office, Washington, DC 20402 (1990 edition).

7. IARC Monographs on the Evaluation of the Carcinogenic Risk of chemicals to Man, World Health Organization Publications Center, 49 Sheridan Avenue, Albany, New York 12210 (Volumes 1-48 and Supplements 1-8).
8. NIOSH/OSHA Pocket Guide to Chemical Hazards. NIOSH Pub. No. 85-114, U.S. Government Printing Office, Washington, DC, 1985.
9. Occupational Health Guidelines, NIOSH/ OSHA. NIOSH Pub. No. 81-123 U.S. Government Printing Office, Washington, DC, 1981.
10. Patty, F.A., Industrial Hygiene and Toxicology, John Wiley & Sons, Inc., New York, NY (Five Volumes), 1985 edition.
11. Registry of Toxic Effects of Chemical Substances, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, Revised Annually, for sale from Superintendent of Documents U.S. Govt. Printing Office, Washington, DC 20402, 1990 edition.
12. The Merck Index: An Encyclopedia of Chemicals and Drugs, Merck and Company Inc. Rahway, N.J., 1976 (or 1983 edition).
13. Sax, N.I. Dangerous Properties of Industrial Materials, 5th edition, Van Nostrand Reinhold, NY, 1979.
14. Sittig, Marshall, Handbook of Toxic and Hazardous Chemicals, Noyes Publications, Park Ridge, NJ, 1981.

Information on Ventilation:

1. American Conference of Governmental Industrial Hygienists Industrial Ventilation, 16th edition Lansing, MI, 1980.

2. American National Standards Institute, Inc. American National Standards Fundamentals Governing the Design and Operation of Local Exhaust Systems ANSI Z 9.2-1979 American National Standards Institute, NY, 1979.
3. Imad, A.P. and Watson, C.L. Ventilation Index: An Easy Way to Decide about Hazardous Liquids, Professional Safety pp 15-18, April 1980.
4. National Fire Protection Association, Fire Protection for Laboratories Using Chemicals NFPA-45, 1982.

Safety Standard for Laboratories in Health Related Institutions, NFPA, 56c, 1980.

Fire Protection Guide on Hazardous materials, 7th edition, 1978.

National Fire Protection Association, Battery-march Park, Quincy, MA 02269.
5. Scientific Apparatus Makers Association (SAMA), Standard for Laboratory Fume Hoods, SAMA LF7-1980, 1101 16th Street, NW, Washington, DC 20036.

Information on Availability of Referenced Material:

1. American National Standards Institute (ANSI), 1430 Broadway, New York, NY 10018.
2. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA19103.

County of San Bernardino

LABORATORY SAFETY STANDARDS
CODE OF SAFE PRACTICES

- | | | | |
|----|--|-----|---|
| 1. | Skin contact with all laboratory chemicals is to be strictly avoided by employees. | | clothing, prior to leaving a potentially contaminated work area. |
| 2. | Do not underestimate the risks of laboratory chemical exposure. Assume that chemicals are toxic unless known to be and identified as safe. | 8. | Employees are to wash their hands as soon as is feasible after removal of protective clothing and/or gloves. |
| 3. | It is the responsibility of each individual to use appropriate and available ventilation devices so as to prevent the escape of airborne substances into the work place. | 9. | Eating, drinking, smoking, applying cosmetics or lip balm and handling contact lenses are strictly prohibited in work areas where there is a reasonable likelihood of contact or exposure to toxic chemicals or other sources of contamination. |
| 4. | Know the location of and use appropriate Personal Protective Equipment at all times. | 10. | Food, drink or condiments shall not be kept in refrigerators, freezers, shelves, cabinets, counter tops, or bench tops where there is a reasonable likelihood of contact or exposure to toxic chemicals or other sources of contamination. |
| 5. | Report all exposure incidents to your immediate supervisor. | | |
| 6. | Dispose of all wastes according to procedure. | 11. | Do not use mouth suction for pipeting or starting a siphon. |
| 7. | Remove all Personal Protective Equipment, as well as protective | | |

I have read and understand the preceding safe work practices. I am aware that in addition to increasing the risk and possibility of serious illness, failure to comply with these guidelines could result in a significant reduction in my benefits should an occupational illness result.

Date

Signature